

Claims:

1. A method for negative feedback controlling electrical power delivered to an electrical load comprising:

- monitoring electrical power delivered to said load,
5 thereby generating an analogue monitoring signal;
- analog to digital converting said analog monitoring signal to generate a digital monitoring signal;
- forming in dependency of said digital monitoring signal and of a preselected rated value signal a control deviation signal;
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- adjusting said electrical power delivered and monitored in function of said control deviation signal,
characterized by performing said analog to digital converting at least twice in parallel.

15 2. A method for negative feedback controlling electrical power delivered to an electrical load comprising:

- monitoring electrical power delivered to said load, thereby generating a monitoring signal;
- forming in dependency of said monitoring signal and of a
20 rated value signal a control deviation signal;
- adjusting said electrical power delivered and monitored in function of said control deviation signal by means of pulse-width modulation with a predetermined pulse repetition period;
- 25 • said pulse-width modulation being adjustable with a predetermined minimum pulse-width adjustment increment;

characterized by calculating from said control deviation signal a desired pulse-width adjustment increment and applying an integer multiple of said predetermined minimum pulse-width adjustment increments to said pulse-width modulation and/or a pulse of predetermined length so often in time, that adjustment by said integer multiple and/or said pulse accords, averaged over time, with a pulse-width modulation adjustment with said desired pulse-width adjustment increment.

10 3. A method according to claim 2, characterized by

- generating by said monitoring an analog monitoring signal;
- analog to digital converting said analog monitoring signal to generate a digital monitoring signal;
- 15 • performing said analog to digital converting at least twice in parallel.

4. The method of claim 1 or 3, characterized by performing each of said analog to digital convertings with oversampling.

20 5. The method of claim 1, 3 or 4, characterized by the fact of performing said analog to digital convertings at a respective equal sampling rate.

6. The method of claim 5, characterized by performing said analog to digital convertings at a constant sampling 25 rate.

7. The method of claim 1, 3 to 6, characterized by performing said analog to digital convertings synchronously.

8. The method of one of claims 1, 3 to 7, characterized by performing each of said analog to digital convertings with a sampling rate of at least 100 kHz.
9. The method of claim 2 or 3, characterized by selecting
5 said predetermined length equal to said predetermined minimum pulse-width adjustment increment.
10. The method of one of the claims 2, 3 to 9,
characterized by applying said pulse of predetermined
length as a pulse-frequency modulation with only a variable
10 pulse repetition frequency.
11. The method of claim 10, characterized by modulating
pulse repetition period of said pulse-frequency modulation
by an integer multiple of said pulse repetition period of
said pulse-width modulation.
- 15 12. The method of one of claims 2, 3 to 10, characterized
by adjusting pulse-width of said pulse-width modulation by
an integer multiple of said predetermined minimum pulse-
width adjustment increment, integrating the resulting
control deviation in time or adding the resulting control
20 deviation in subsequent pulse-repetition periods, and
applying said single pulse of predetermined length,
whenever the result of said integrating or of said adding
accords with a control deviation which necessitates
adjusting said pulse-width by a predetermined minimum
25 pulse-width adjustment increment.
13. The method of one of claims 1 to 12, characterized by controlling electrical power of at least 100 VA.
14. The method of one of claims 1 to 13, characterized by monitoring said electrical power by monitoring current or
30 voltage delivered to said load.

15. A negative feedback-controlled power supply comprising:

- a monitoring unit monitoring electric power delivered to a load and having an analog monitoring signal output,

5 - an analog to digital converter unit having an analog signal input being operationally connected to said analog monitoring signal output and having a digital monitoring signal output,

- a controller unit with a digital signal input operationally connected to said digital monitoring signal

10 output and further having a control output, further comprising a difference forming unit, a first input thereof being operationally connected to said digital monitoring signal input, a second input thereof being operationally connected to an output of a rated value signal source and further having a difference signal output operationally connected to said control output,

15 - a power adjusting unit with a power input, a power output and a control input, said power output being operationally connected to an input of said monitoring unit and being operationally connectable to said load, the control input being operationally connected to said control output,

20 characterized by the fact that

25 said analog to digital converter unit comprises at least two analog to digital converters, the analog inputs thereof being operationally connected to said analog signal input and having a digital signal output each being operationally connected to said digital monitoring signal output, further comprising a sampling/converting control unit with at least

two sampling/converting control outputs, said at least two sampling/converting control outputs being operationally connected respectively to a sample/converting control input of each of said at least two converters, said
5 sampling/converting control unit generating at said at least two sampling/converting control outputs sample and conversion enabling signals.

16. A negative feedback-controlled power supply, comprising:

- 10 - a monitoring unit monitoring electric power delivered to a load and having a monitoring signal output,
- a controller unit with a monitoring signal input operationally connected to said monitoring signal output and further having a control output, a difference forming unit, a first input thereof being operationally connected to said monitoring signal input, a second input thereof being operationally connected to an output of a rated value signal source, and further having a difference signal output, a pulse-width control unit with a pulse-width control input operationally connected to said difference signal output and having an output operationally connected to said control output and generating at said control output a pulse-width modulated control signal;
- 25 - a power adjusting unit with a power input, a power output and a control input, said power output being operationally connected to an input of said monitoring unit and being operationally connectable to a load, the control input being operationally connected to said control output, said power adjusting unit further comprising a power-pulse-width modulation unit with a
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5 pulse-width control input operationally connected to said control input and with an input operationally connected with said power input and with an output operationally connected to said power output, said power-pulse-width modulation unit transmitting a signal applied to said power input, pulse-width modulated to said power output with a predetermined minimum pulse-width adjustment increment,

characterized by the fact that

- 10 said controller unit further comprises a calculation unit, one calculation input thereof being operationally connected to said difference signal output, the calculation output thereof being operationally connected to said pulse-width control input and calculating in dependency of a signal applied to said calculation input a desired pulse-width adjustment increment at said pulse-width modulation unit, said calculation unit generating at said calculation output a first control signal controlling adjustment of pulse-width of said pulse-width control unit by an integer number 15 of said predetermined minimum pulse-width adjustment increment according to an integer of the ratio of said desired pulse-width adjustment increment and said predetermined minimum pulse-width adjustment increment, and generating at said calculation output a second control 20 signal controlling frequency of a frequency modulated pulse train with a pulse of predetermined pulse-width according 25 to a fraction of the ratio of said desired pulse-width adjustment increment and said predetermined minimum pulse-width adjustment increment.
- 30 17. The negative feedback control power supply according to claim 16, characterized by the fact that said monitoring

signal output is an analog monitoring signal output and said monitoring signal input is a digital monitoring signal input and further comprising an analog to digital converter unit interconnected between said analog monitoring signal
5 output and said digital monitoring signal input and comprising at least two analog to digital converters, the analog inputs thereof being operationally connected to said analog monitoring signal output and having a digital signal output each being operationally connected to said digital
10 monitoring signal output and further comprising a sampling/conversion control unit with at least two sampling/converting control outputs, said at least two sampling/converting control outputs being operationally connected respectively to a sample/converting control input
15 at each of said at least two converters, said sampling/conversion control unit generating at said at least two sampling/converting control outputs sample and convert enabling signals.

18. The power supply according to one of claims 15 to 17,
20 said power adjusting unit adjusting a power delivered to said load of at least 100 VA.

19. The power supply according to one of claims 15 to 18, wherein a power at said power output is controlled with a resolution of at least 10 ppm, preferably with a resolution
25 of at least 1 ppm.

20. A synchrotron system with electron beam-controlling magnets, said magnets being electrically supplied by power supplies according to one of the claims 15 to 19.